PRACTICAL
PW WINERY & VINEYARD
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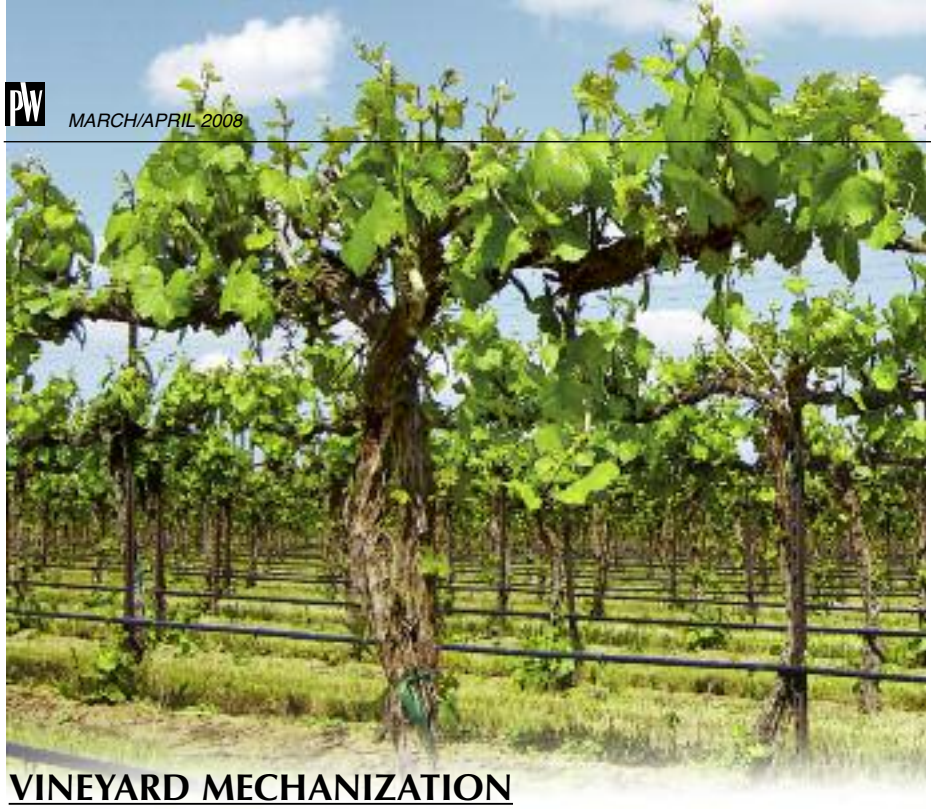

Well-spaced shoots on vertical shoot-positioned Chardonnay vines after mechanized shoot-thinning with Korvan 2220 tow-behind tool carrier.

VINEYARD MECHANIZATION

ACHIEVING CONSISTENT QUALITY AND YIELD

Several growers have adopted the relatively new practice of mechanical shoot-thinning to their mechanized vineyard operations in addition to pruning and cluster-thinning (when necessary), to achieve sustainable quality and yield with minimal labor input. ***PWV*** offers four case studies below, sharing experience in California, Washington, and Missouri.

MESA VINEYARD MANAGEMENT (CALIFORNIA)

Mesa Vineyard Management [Templeton, CA] has purchased a Korvan-2220 tow-behind tool carrier with a self-contained hydraulic and electronic control system (hydraulically-powered by the tractor). Two operators are seated in the tool carrier with hand controls to guide boom-mounted attachments with electric-over-hydraulic control of the boom lift-and-swing movements.

"We rented a Korvan tool carrier in 2006 and began operations on 60 acres located in four vineyards," recalls Gregg Hibbits (general manager, Mesa Vineyard Management). "In 2007, we increased acreage to about 300 acres on five vineyards. The Korvan tool carrier was used to prune all vineyards. Later in the season, shoot-thinning was done, and removal of unwanted shoots from the underside of the cordon, and crop-thinning as necessary.

"With purchase of the Korvan-2220, we hope to do four passes (if all four are deemed necessary) over 700 acres in 2008: mechanical-pruning, shoot-thinning, sucker-removal below the cordons, and cluster-thinning on five ranches in San Luis Obispo and Monterey Counties.

"Our grape-priority for mechanical applications is Cabernet Sauvignon, Merlot, and Syrah that yield five to seven tons per acre. We have three trellis configurations: vertical shoot-positioned, modified sprawl, and Smart-Dyson. In general, machine activities work better once the cordon is completely established, that is once the wire is filled. That generally occurs in the fourth or fifth year.

"We pull the Korvan tool carrier with a John Deere-6420 in tractor-row widths from 10-feet down to eight-feet. A John Deere-5520 pulls the Korvan tool carrier in six-foot wide tractor-rows. The unit is operated in one 10-hour shift per day at 2 to 2.5 mph.

"Pruning with a tow-behind tool carrier is basically an attempt to mechanically-prune spur-pruned vines within a very tight 'box.' We are trying to avoid ending up with an annually expanding area of dead wood around the cordon.

"The tool carrier with rotary pruning equipment allows us to fine-tune mechanical pruning because of a high level of specificity in pruner operation,

Mechanized pruning with Korvan 2220 tow-behind tool carrier at Red Hills Vineyard (Creston, CA).

A Korvan 1220 tool carrier with a rotary-paddle attatchment is used to remove approximately 40% of the shoots from Cabernet Sauvignon vines (Ste. Michelle Wine Estates, Washington).

achieved by having a person only focus on the operation of one rotary pruning head. Our goal is not necessarily to end up with 125% or 175% of desired buds, but to end up with a 'tight box,' that will have more buds than are necessary.

"The 'fine' adjustments from approximately 175% of desired bud count to 150% to 100% are achieved by the subsequent operations of shoot-thinning, cordon-brushing, and cluster-thinning. The progression could also be 150% at pruning reduced to 100% at shoot thinning with no cluster thinning needed, or any other possible combination of operations.

"We begin shoot-thinning when shoots are an average of six to 12 inches in length.

"Shoot-thinning (by hand), tends to be a 15- to 25 man-hour per acre operation, depending on shoot growth (longer shoots take more time) and how 'clean' the shoot thinning needs to be. The tow-behind tool carrier requires two people plus tractor driver and one or two supervisors to count shoots. If we can do two acres per hour with the tool carrier, that is roughly 2.5 man hours per acre. The man-hour cost calculation will be higher for the mechanical operation as tractor drivers earn $10 to $12 per hour and a thinning crew member earns $8 to $9 per hour.

Cluster-thinning is generally the last canopy operation of the season and may be eliminated if the crop estimate is low or on-target. The determination on cluster-thinning is made on a block by block, variety by variety basis."

"Cost savings calculation is difficult," says Dana Merrill (president of Mesa Vineyard Management). "On average, we believe that we probably save in the range of 15% to 20% compared to conventional pruning, that includes a quick clean-up pass around the tall vine-stakes.

"We feel the pay-off will be, as labor rates rise, our costs will remain fixed, to some extent. The comparison will then swing more favorably to the mechanical approach. I expect that growers selling grapes for $1,200 or less will not be able to afford many of the common hand-labor practices used today such as pruning, cordon-suckering, weak shoot-removal, and cluster-thinning. But some wineries will be more supportive than others as transitions are made, similar to the reception that mechanical grape harvesting received in the early years."

French Camp Vineyards (California)

French Camp Vineyards (Santa Margarita, CA) operates three Korvan-2220 tow-behind tool carriers on 1,100 acres of six varieties of red and white grapes. In three passes during the year, pruning, shoot-thinning, and cluster-thinning operations are performed on vertical shoot-positioned vines, two-foot wide Lyre, three-foot wide quadrilateral trellis, and two-foot wide U-Lyre trellis.

"We began trial-development on about 50 acres in 2002 with purchase of tractor-mounted machinery from Fresno State University," recalls Hank Ashby, French Camp vineyard manager. "In 2003, the manufacturer, OXBO International, delivered the first two-row trailer tool carrier with dual booms, dual operator stations, and a supervisor platform on a lease.

"We operated two trailers with an OXBO rotary shoot-thinning attachment on 450 acres. We also used a cordon-impactor cluster-thinning attachment suitable for horizontally-divided trellises such as quadrilateral and lyre.

"In 2004, we purchased three improved second generation OXBO tool carriers including sickle-bar pruners to operate on 900 acres. We trialed a

Mechanized shoot-thinning with Korvan 2220 tow-behind tool carrier at French Camp Vineyards (Shandon, CA).

Quadrilateral cordon vine after mechanized shoot-thinning at French Camp Vineyards (Shandon, CA) with seven clusters remaining, per linear foot of cordon.

single-action sickle bar vine trimmer and horizontal and vertical trunk brush-cleaner prototypes.

"By 2005 we increased to 1,100 acres under mechanized farming practices. We look forward to continuing at this level into the future with the three machines that we now own."

"We have conducted trials every year to compare grape quality from hand and mechanized procedures on Cabernet Sauvignon, Cabernet Franc, Chardonnay, Sauvignon Blanc, Shiraz, and Zinfandel. We are achieving equal quality from mechanized blocks at a cost savings of 47%.

"The balanced cropping system is very sustainable. When we started the project, we expected we would have to do a 'clean up' every four or five years, but it appears not to be necessary. New spurs appear each year as we move the pruning cuts closer to the cordon," concludes Ashby.

STE. MICHELLE WINE ESTATES (WASHINGTON)

Ste. Michelle Wine Estates is dedicated to producing premium wines while utilizing the most sustainable practices available. "Mechanical vineyard management allows us to perform quality improvement practices in vineyards that normally would not receive these practices due to economic constraints," explains Dr. Russell Smithyman, (director of viticulture & research, Ste. Michelle Wine Estates, Washington state).

Ste. Michelle Wine Estates continues to develop and utilize other precision viticulture practices along with mechanization, that have great potential for improving wine quality while reducing production costs, such as differential mechanical harvesting.

In 2007, a Korvan tractor-mounted rotary-finish pruner was used to mechanically pre-prune two rows simultaneously (single tractor-pass) of 100 acres of Cabernet Sauvignon vines.

"The rotary-finish pruner was used to prune vines to a tighter tolerance," adds Smithyman, "which, in effect, minimized hand follow-up. For Cabernet Sauvignon, the trellis is a VSP setup farmed as a sprawl — four movable wires (two on each side), and one fixed wind-wire on top.

"For shoot-thinning, a rotary-paddle attachment was used to remove approximately 40% of the crop load from the top and sides of the cordon (shoots are six inches in length).

"The 1220 tool carrier uses ground sensing radar and user inputs to the OXBO Plus 1 computer system, to maintain constant speed calibration of the rotating urethane fingers, regardless of forward tractor speed and wheel slippage. The driver uses a single joystick to manipulate the height and lateral position of each head independently. Our operators have become quite good at driving the tractor while juggling the duties of shoot-thinning two vine rows."

A rotary cordon-brush was used to remove shoots from the bottom of the cordon and the side of the trunk (from the drip-wire up to the cordon).

"We were very impressed with the openness of the canopy after shoot-thinning. We were very impressed with the cordon-brush and removal of trunk-suckers; so much so that we expanded use of this implement into additional vineyard blocks.

"We experimented with cluster-thinning in a few rows but do not yet have any firm conclusions. We will experiment with the cluster-thinning attachment on a larger scale in 2008.

"In 2008, we plan to operate the Korvan-1220 tool carrier on the same 100 acres of Cabernet Sauvignon plus 30 acres of Chardonnay. With the results achieved in 2007, and the expected results in 2008, we feel confident that this program will work in other varieties such as Merlot and Syrah.

"Pre-pruning costs with the Korvan-1220 double-arm tractor-mounted tool carrier were 50% of conventional single-row pre-pruning costs. The follow-up hand-pruning pass, a quick (walking-pace) pass to remove hangers in the first year, was 25% less cost than our conventional pneumatic pruning pass.

"For shoot-thinning, we incurred 20% of normal hand shoot-thinning costs. We also feel that a cordon-brush pass, combined with a well-timed chemical-sucker pass, could potentially, depending on seasonal conditions, eliminate the need for a hand-sucker pass.

"We feel that the Korvan tool carrier system has the potential to play an important role in our goal to improve quality at reduced costs in many vine-

yards. We will continue to investigate its use to improve wine quality, but also its use in combination with other precision viticulture technologies to improve vineyard uniformity and sustainability," concludes Smithyman.

ST. JAMES WINERY (MISSOURI)

St. James Winery (St. James, MO), Oxbo International Corp., and the University of Missouri began a study in 2006 to evaluate the effects of mechanical-pruning and shoot-thinning compared to manual operations on Chardonel (a hybrid winegrape with parentage of Chardonnay X Seyval blanc).

Mechanization of hybrid cultivars such as Chardonel may be more complicated than for *V. vinifera* and *V. labruscana* because many are, at least, moderately fruitful from non-count, basal buds and from secondary buds. Consequently, shoot growth from either origin can contribute to yield, and this attribute warrants close study.

The experimental plot (approximately five-acres) is located within 12 acres of Chardonel vines six years old within the St. James' Tower Vineyard in central Missouri. The vineyard is planted on a Union silt loam soil with artificial drainage and drip irrigation. Vines are grafted to 3309C rootstock. Vine and row spacing is 7-foot x 9-foot, respectively, and vines are trained to a high bilateral cordon that is shoot-positioned downward.

Treatments include hand-pruning plus hand shoot-thinning, hand-pruning plus mechanized shoot-thinning, mechanized-pruning plus hand shoot-thinning, and mechanized-pruning plus mechanized shoot-thinning.

Hand-pruning to short fruiting canes was performed to retain 20 nodes per pound of pruning weight, while mechanized-pruning was to a 13-inch square box positioned as low on the trellis as possible.

Shoot-thinning, both by hand and machine, was to three shoots per foot of canopy as specified by the vineyard manager. Mechanical-pruning and shoot-thinning were performed with a Korvan 1210 tool carrier. Data being collected for this experiment include yield and yield components, vegetative growth, leaf area by shoot origin, and fruit composition by source (count, non-count, and lateral shoots).

Data were collected from 320 vines in 2006 and 2007. Unfortunately the data collected for the 2007 season were significantly impacted by the severe freeze that occurred in early April. Because these seasons have been so different, and because 2007 data collection is not yet complete, no strong conclusions from our data have been made, but there are two general observations:

First, mechanized pruning, as performed, retained node numbers nearly double that of hand-pruning. In combination with the fact that 2006 season-end shoot densities appear to have increased significantly after shoot- thinning, we suspect we may need to machine-prune Chardonel vines more aggressively.

The experimental protocol will be amended to more precisely monitor post-thinning shoot development. Allowing the development of shoots and crop from non-count buds may improve balance in this cultivar.

Second, yield data from the 2007 season demonstrate a numerical yield advantage for the machine-pruned vines. Further analysis of the data is under way. We hope for "normal" conditions in 2008 and 2009 to allow a more thorough examination of the effects of these practices.

"We will operate the Korvan 1210 tool carrier on all of our 20 acres of Chardonel in 2008," says Andrew Hofherr, St. James Winery president.

Report by Eli Bergmeier, Keith Striegler (University of Missouri) ■

For more on vineyard mechanization:
See **SMART VITICULTURE** column
"Mechanization – California agriculture's future"
in September/October 2003
Practical Winery & Vineyard